Metaphors of Objectivity

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INTRODUCTION

Historical meta-epistemology, to use Ian Hacking's term, is a method for understanding epistemological concepts. It involves studying the evolution of such concepts as they change depending on who is using them and in what historical period. An important example of such a concept is objectivity: "Objectivity denotes a family of ideas, from matriarch to great-grandchild, from renegade uncle to stalwart but lonely aunt."[1] That the collection of 'objectivities' should be expressed by a metaphor is particularly apt, as metaphor is an important means by which different conceptions of objectivity are expressed. Metaphors are especially prominent in the work of two major theorists of scientific objectivity, Sir Francis Bacon and Sir Karl Popper. An analysis of these metaphors sheds light on the theories' key elements, basic assumptions, and respective conceptual, cultural, and historical contexts. The results of this analysis point to a problematic relationship between Bacon and Popper's theories of objectivity and the metaphors used to express them.

In terms of procedure, I begin by clarifying what I understand by "metaphor." I then analyse Bacon and Popper's metaphors by paying close attention to their metaphorical language. Finally, I expose the problems posed for these theories as a result of their use of metaphor, and sketch some of the ways in which metaphor can help yield a better understanding of epistemological concepts and of science.

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WHAT IS METAPHOR?

There are many theories of metaphor. As a result, there are many different, sometimes conflicting, views of metaphor's nature and function. Choosing one particular theory would require extensive justification, which I am unable to provide here – that would be a paper in itself. Also, as Ortony has pointed out, one's view of metaphor often depends on one's view of objectivity, and *vice versa* – and I do not wish to pre-judge my topic.[2] As a result of these considerations, I suggest the following broad, non-technical – and, I hope, uncontroversial – formulation of metaphor: "*the essence of metaphor is understanding* […] *one kind of thing in terms of another*."[3] Metaphor is expressed by metaphorical language; this broad conception includes simile and analogy. On this basis, I will identify and analyse the metaphors present in Bacon and Popper's theories; the analysis will reveal their nature and function *in context*, rather than in general.

BACON'S METAPHORS

Sir Francis Bacon, "the father of modern science," as he is sometimes called, is one of the most important figures in the history and philosophy of science. There is no doubt that, for Bacon, modern science is meant to be objective.[4] His intentions are clear: "I am building in the human understanding a true model of the world, not such as a man's own reason would have it be."[5] Elsewhere, he states that scientific knowledge refers to the universe, not to man.[6] Bacon relies heavily on metaphors to explain and defend his conception of scientific objectivity. In fact, almost every page of the *New Organon* contains metaphorical language, and extended metaphorical passages are common. These metaphors express Bacon's vision of objective knowledge, his method for obtaining such knowledge, and the legitimacy, justification, and value of his project.

What is objective knowledge, for Bacon? Objectivity is best understood in relation to its converse, subjectivity.[7] Bacon expresses the nature of subjective and objective knowledge by

means of the metaphor of light. Bacon devotes a great deal of effort to characterizing human subjectivity and explaining how it results in erroneous beliefs about the world. His treatment of the Four Idols is well known, and, although it is thoroughly metaphorical, I will not go into it here because it has already been studied extensively. The metaphor of light condenses the conclusions of the Four Idols treatment into a single image: "the human understanding is like a false mirror which, receiving rays irregularly, distorts and discolors the nature of things by mingling its own nature with it."[8] The idea that the mind is a mirror which reflects the external world is one of the oldest and most deeply-rooted beliefs in Western philosophy. This metaphor clearly exposes one of Bacon's most basic assumptions about the nature of the mind. It can also be seen as a manifestation of a general operating assumption common to many philosophers of the seventeenth century, namely, that any account of knowledge must begin with an account of the mind.

Bacon's conception of objective knowledge is expressed by the same light metaphor: "the knowledge of simple natures well examined and defined is as light."[9] This light, however, is not scattered or distorted by the uneven mirror of the mind; rather, objective knowledge is a reflection of the "genuine rays of things."[10] It is attained in the following manner: "I, on the contrary, dwelling purely and constantly among the facts of nature, withdraw my intellect from them no further than may suffice to let the images and rays of natural objects meet in a point, as they do in the sense of vision; whence it follows that the strength and excellency of wit has but little to do in the matter."[11] Objective knowledge is genuine knowledge of the facts of nature, independent of subjective distortions.[12] This metaphor is completely intelligible to readers today, as we are familiar with the phenomenon of the refraction of light and its role in vision. But it is precisely because this imagery is so commonplace to us that we risk missing the full significance of the metaphor in Bacon's philosophy. For that, we must relate it to its historical context. What we discover is that such a metaphor simply would not have been possible before the seventeenth century. Bacon is referring to the

spectacular contemporary discoveries in the field of optics regarding the composition and refraction of light, the properties of convex and concave lenses, the working of the eye, etc. by men like Kepler, Newton, and Descartes. The historical context, thus, allows us to appreciate the novelty of Bacon's metaphor. It also reveals its powerful rhetorical function: Bacon manages to associate his conception of objectivity with the revolutionary discoveries and progress made by the scientific greats of his century. Finally, we see that Bacon's argument is circular in that this metaphor for objectively true scientific knowledge relies on our prior acceptance of the objective truth of the scientific discoveries upon which it is based.

Bacon, like many other philosophers of the seventeenth century, believed that a proper method was the key to obtaining knowledge. As has already been stated, there was also a strong preoccupation with the mind during that period. In addition, Bacon attached a high value to instruments - products of, and means for producing, works. All of these motivations are combined in a metaphor: *method is an instrument for the mind*. This metaphor is so important that it is introduced in the second aphorism of the *New Organon*: "Neither the naked hand nor the understanding left to itself can effect much. It is by instruments and helps that the work is done, which are as much wanted for the understanding as for the hand. And as the instruments of the hand either give motion or guide it, so the instruments of the mind supply either suggestions for the understanding or cautions."[13] Bacon's method is a collection of instruments that caution the human understanding against the dangers of subjectivity, and guide it towards objective knowledge of nature by means of the true induction.

The instruments of the *mind* metaphor is justified by the power and utility of the instruments of the *hand* in Bacon's world. Of "printing, gunpowder, and the magnet," he claims that "no empire, no sect, no star seems to have exerted greater power and influence in human affairs than these mechanical arts."[14] Thus "human knowledge and human power meet in one;" each justifies the other.[15] Via the mariner's needle, Bacon metaphori-

cally links global exploration with intellectual exploration. This instrument, a guide to the mariner, made possible the discovery of the New World. Likewise, Bacon's intellectual instrument, a guide to the mind, will open up vast new intellectual horizons.[16] Thus, by means of metaphor, Bacon manages to associate his method with the most successful instruments of his day, and all of their impressive and valuable discoveries.

The metaphor also functions polemically: it is a devastating illustration of the obsolescence of Scholasticism and the ancient knowledge upon which it was based. Aristotle had simply never seen printing, gunpowder, or magnets; his intellectual horizon encompassed the Old World, but not beyond. This powerful rhetoric was made possible by the historical circumstances. Bacon's metaphor reveals how closely objectivity in the seventeenth century was associated with technological developments. Here we see the beginnings of the linkage of objective science with progress, an important idea in the history of objectivity. It is important to note that for Bacon, unlike for many later thinkers (*e.g.* Popper), objective science is linked not to an abstract conception of progress (*e.g.* Popper's formula for rational progression), but to concrete technological products – instruments that tangibly increase man's power over the natural world.

For Bacon, objective science's legitimacy, justification, and value are metaphorically expressed through the image of fruit. Indeed, all three of these elements are brought together by the metaphor of fruit. This metaphor links Bacon's objective science to a religious context: "Wherefore, as in religion we are warned to show our faith by works, so in philosophy by the same rule the system should be judged of by its fruits, and be pronounced frivolous if it be barren; more especially if, in place of fruits of grape and olive, it bears thorns and briars of dispute and contention."[17] The value of Bacon's philosophy derives from its capacity to produce fruits: knowledge and technology that increase man's power over nature. These fruits also justify it, just as the faithful are justified on the Day of Judgment by their good works.

This metaphor, explicitly linked as it is to religion, can only be fully understood in its specifically Christian context.

Fruit imagery is ubiquitous in the Bible; Bacon's Christian readers would likely have associated his metaphor with a passage like this one, from Jesus' Sermon on the Mount: "Beware of false prophets, who come to you in sheep's clothing but inwardly are ravenous wolves. You will know them by their fruits. Are grapes gathered from thorns, or figs from thistles? In the same way, every good tree bears good fruit, but the bad tree bears bad fruit."[18] Fruits, according to this way of thinking, are objective evidence of legitimacy. Indeed, the need to distinguish false prophets from legitimate ones was especially acute in Bacon's time. The seventeenth century was characterized by religious turmoil, after new "prophets" like Luther and Calvin had proclaimed new religious truths, and accusations of heresy flew back and forth. Bacon's fruit metaphor would have resonated with readers who desperately sought objective proof of legitimacy and truth in an age when all was in doubt, in religion as in philosophy.

The image of fruit and the associated images of harvesting express Bacon's deeply religious view of the task of science: redemption. Fruits are cultivated and harvested by the farmer; Bacon patiently applies his method to produce works. "For though it is true that I am principally in pursuit of works […], yet I wait for harvest time, and do not attempt to mow the moss or to reap the green corn."[19] Bacon, as the farmer, assumes the role of Adam, who was condemned to labour the earth in the sweat of his brow as a punishment for original sin.[20] The religious hope is that such labour is redemptive, that "if we labour in thy works with the sweat of our brows, thou wilt make us partakers of thy vision and thy Sabbath."[21] Objective knowledge (God's vision) and spiritual redemption (God's Sabbath) meet in one. Bacon firmly anchors his project's legitimacy, justification, and value in the religious context of his time.

POPPERS'S METAPHORS

Sir Karl Popper was one of the most influential proponents of scientific objectivity of the twentieth century. His posi-

tion is clear: "All work in science is work directed towards the growth of objective knowledge. We are workers who are adding to the growth of objective knowledge as masons work on a cathedral."[22] As this quotation illustrates, Popper, like Bacon, was strongly committed to scientific objectivity, and employed metaphor to explain and defend his position.

Popper's account of objective knowledge rests on his ontology of the three worlds: the physical world, the mental world, and "the world of intelligibles, or of *ideas in the objective sense*; it is the world of possible objects of thought, the world of theories in themselves, and their logical relations; of arguments in themselves; and of problem situations in themselves."[23] All objective knowledge belongs to and thereby constitutes "World 3."

In "Knowledge: Objective Versus Subjective," Popper takes a "biological approach" to World 3; that is, he explains it in biological terms. His first thesis regarding World 3 is that it is produced by humans: "World 3 is a natural product of the human animal, comparable to a spider's web."[24] Popper's second thesis is that World 3 is autonomous.[25] This is the crux of his argument: theories-in themselves and the other members of World 3 are emphatically not mental ideas in the subjective sense – if they were, they would not be objective. In order to explain these two theses, Popper invokes several more analogies: "nests built by wasps or ants; the burrows of badgers, dams constructed by beavers, or paths made by animals in forests."[26] Popper's third thesis explicitly appeals to analogy: "there is a close analogy between the growth of objective knowledge and biological growth; that is, the evolution of plants and animals."[27]

How are we to understand this "biological approach?" Bloor explains the strategy as follows: "the point of these analogies is that they allow a naturalistic conception of knowledge as being man-made, but they indicate that, once produced, it is independent of its maker."[28] This is, indeed, Popper's main argumentative point, but I think that the analogies convey much more than this by means of their extended associations.

Nests, dams, burrows, and the like are all tangible physical objects. In the context of the analogy, this is so obvious as to

go without saying, but, in fact, Popper wants very much for the attribute of tangibility to be associated with objective knowledge.[29] Indeed, elsewhere Popper explains our interaction with objective knowledge in precisely such terms: "[the mind] can also 'see' or 'grasp' an arithmetical or geometrical object; a number, or a geometrical figure. But although, in this sense, 'see' or 'grasp' is used in a metaphorical way, it nevertheless denotes a real relationship between the mind and its intelligible object."[30] This *objectivity* reinforces, and is reinforced by, other metaphors, like *knowledge is a cathedral*, that also make this association. Together, these metaphors ease tensions in Popper's ontology. For example, *qua* physical objects, books and libraries belong to the physical world; *qua* humanly-produced objective knowledge, they belong to World 3. The metaphorical association of World 3 with physical objects eases (or hides) such tensions, because within the context of the analogies, where everything is physical, there is no such contradiction.

These analogies associatively imbue scientific objectivity with several glowing attributes. Nests and spiders' webs and the like are complex, ordered, creative, and indispensable to survival. This can be read as an effective rhetorical device, and also as a testament to how highly Popper esteems objective science and its role in society.

The last feature to which I wish to draw attention is the wider context of the analogies. The objects Popper employs to express his vision of objectivity are significant for their intrinsic attributes, as we have seen, but it is essential to see that Popper explicitly characterizes them as *objects of study*, within the framework of *biological science*.[31] The acquisition of objective knowledge is likened to animal and plant evolution – a reference to evolutionary theory in biology. Elsewhere, Popper compares scientific progress to DNA replication, thereby situating his theory in the framework of genetics. Now, if one were asked which field of science achieved the greatest and most influential breakthroughs of the nineteenth and twentieth centuries, there is no doubt that biology, with its theories of evolution and genetics, would be one of the prime candidates. The choice of analogies

from biology is far from accidental. Popper is associating his theory of scientific objectivity with arguably the most successful scientific field of his day. This is the same strategy that Bacon used in the case of optics; it is just as rhetorically effective, and just as circular.

I agree with Bloor that, for the most part, these biological analogies effectively communicate Popper's conception of objective knowledge.[32] The problem, however, is that Popper also *defends* his view by analogy; he moves from the realm of biology to World 3 to make positive claims, but retreats back to the realm of biology to defend himself. For example, Popper addresses the objections to his ontology as follows: "The thesis of the existence of such a world of problem situations will strike many as extremely metaphysically dubious. But it can be defended by pointing out its biological analogue. For example, it has its full analogue in birds' nests."[33] In like manner, he attempts to refute the subjectivist approach to knowledge with analogies: "This view is mistaken in many ways. A wasps' nest is a wasps' nest even after it has been deserted […] A bird's nest is a bird's nest even if it was never lived in."[34] The fundamental problem with this argumentative strategy is that it misuses analogy: analogy can be used to explain a thesis, but not to justify it. At least, this is so in a case like Popper's, who clearly conceives his theory to be *independent* of the analogy (*i.e.*, to be independently valid and apply beyond the realm of biology). The *theory* is the subject-matter of the objections, not the *analogy*. Thus, if Popper's theory is to be independently valid and applicable, it must be defendable on its own terms, but, instead, Popper retreats to his bird's nest.[35]

Popper employs this same strategy elsewhere. In "Normal Science and Its Dangers," he addresses Kuhn's challenge to his account of scientific objectivity. He presents his version of Kuhn's view in the following terms: "This is a widely accepted and indeed a fashionable thesis: the thesis of *relativism*. And it is a logical thesis. … I have dubbed this thesis *The Myth of the Framework* […] I regard it as a logical and philosophical mistake."[36] This quotation illustrates the contradictory nature of Pop-

per's argumentative strategy. On the one hand, the opposing thesis is characterized in logical terms. On the other hand, Popper's frames the debate in terms that are not logical at all, but metaphorical: the opposing thesis is not a logical argument, but rather a passing "fashion," *en vogue* this season, soon to be *passé*; moreover, the thesis does not even belong to the realm of logic and philosophy – it is a "myth," irrational and false. Thus Popper himself is guilty of making a "logical and philosophical mistake:" according to his formulation, the thesis of relativism is both logical and alogical.

Popper replies to this thesis by a series of metaphors and analogies, *not* by strictly logical argument. Indeed, he never really interprets the relativist thesis logically, so it is not surprising that he does not refute them in such terms. Rather, he interprets the thesis metaphorically, and responds in kind:

> I do admit that at any moment we are prisoners caught in the framework of our theories; our expectations; our past experiences; our language. But we are prisoners in a Pickwickian sense: if we try, we can break out of our framework at any time. Admittedly, we shall find ourselves again in a framework, but it will be a better and roomier one; and we can at any moment break out of it again.[37]

Similarly, his reply to the relativist idea that "different frameworks are like mutually untranslatable languages" remains internal to the analogy. He points out that different languages, like English and Hopi, can in fact be translated.[38]

After several additional metaphors, Popper concludes his attack on the Myth of the Framework by restating his account of scientific objectivity: "'scientific knowledge' may be regarded as subjectless. It may be regarded as a system of theories on which we work as do masons on a cathedral."[39] We are back where we started; Popper's explanation of objectivity and his defence of it are thoroughly metaphorical.

THE DILEMMA

The foregoing analysis of metaphor in Bacon and Popper's theories of objectivity reveals, in short, that metaphor explains and defends key concepts in a fashion that could not be done literally, and links each theory to the wider conceptual, cultural, and historical context upon which it depends. These theories are *not* independent of the metaphors used to explain and defend them. In reality, metaphor is significantly *constitutive* of them. Herein lies the problem. Metaphor, given its nature and function in Bacon and Popper's theories, does not match their own conceptions of what objectivity is supposed to be. Metaphor is not objective, but their theories of objectivity are significantly metaphorical. The result is a dilemma, of which both horns lead to the same problematic result. On the one hand, to the extent that we accept the metaphors, we must reject their accounts of objectivity. On the other hand, to the extent that we reject the metaphors, we must reject the accounts of objectivity to which they are integral.[40] I will now outline the problem as it arises in connection with three central characteristics of objectivity for Bacon and Popper: the distinction between knower and known, the association of objectivity and rationality, and the rejection of frameworks.

Objectivity is founded on the distinction between the knower and the known. Subject and object are meant to be as distinct as possible. For Bacon, objective knowledge refers to the universe, not to man. For Popper, "knowledge in the objective sense is *knowledge without a knower*: it is *knowledge without a knowing subject*."[41] In metaphor, however, the knower and the known are *not* separate. Rather, the essence of metaphor is to condense and unite the various elements under consideration into a single image, which cannot be teased apart. Metaphor makes the boundaries between categories fluid, not rigid. In addition, metaphor, in order to be understood, implicates a situated subject. It is a view from somewhere, a viewpoint of someone in particular. Understanding Bacon's fruit metaphor, for example, depends on

assuming the particular perspective of an educated, Christian person in the seventeenth century. So, to the extent that Bacon and Popper's theories are constituted by metaphor, they are not, by their own standards, objective. Thus, if we reject metaphor because it is not objective, we must then reject the theories on the same grounds. On the other hand, if we accept that Bacon and Popper's theories contribute to the growth of knowledge, then we must also accept that metaphor tells us something true about the world, and that therefore, contrary to these same theories, that there is such a thing as non-objective knowledge.

Objectivity, according to Bacon and Popper, is supposed to be associated with rationality (recall also that both philosophers accuse rival accounts of being illogical and irrational). For Popper, scientific progress is a rational process. Bacon claims that by means of his philosophy he has "established forever a true and lawful marriage between the empirical and rational faculty."[42] This quotation illustrates the problem vividly. The very statement which asserts the rationality of objective science *literally makes no sense*. Faculties are not persons: it makes no sense to say that they can be married. How can a philosophy be a marriage at all? But the metaphor asserts just this, it asserts that Bacon's philosophy is something which it obviously is not. Indeed, "we can even say, in a general fashion, that the strategy of discourse by means of which the metaphoric utterance obtains its result is absurdity."[43] Moreover, logical statements are, by the Law of the Excluded Middle, either true or false. Popper lays great emphasis on the falsifiability of scientific theories. But metaphors are not obviously falsifiable. Take Popper's claim that "we can break out of our prison at any moment." In virtue of what is it true or false? How could it be falsified? Either the above statements and all those like them are absurd, in which case the theoretical claims they make are also absurd, or they are not absurd and the account of objective truth is mistaken (or at least incomplete).

For Bacon and Popper, science yields objective knowledge of the universe as it is in itself, not relative to humans. With Popper this conception is especially important, as he must de-

fend it against rival theories which stress the importance of frameworks in science and indeed all human knowledge acquisition. Through our analysis of metaphor, however, we have seen that frameworks are essential to these very theories of objectivity. First of all, metaphor links these theories to the wider frameworks in which they have their being (*e.g.* for Bacon: religion, optics, technological inventions, global exploration). Moreover, just as Kuhn suggests that frameworks, or paradigms, can be thought of as metaphors blown large, I believe that metaphors are mini-frameworks. So when Popper, for example, likens World 3 to the productions of birds and other animals, he actually incorporates it into whole system of associations, like tangibility, utility, complexity, and so forth. The theories belong to large frameworks, and are themselves made up of mini-frameworks. When it comes to defending his theory against "The Myth of the Framework," Popper resorts to a whole string of metaphors; while he insists that frameworks do not constrain us because we can escape from them, he is capable neither of escaping from them, nor of providing an answer which would be verifiable or falsifiable outside of these frameworks. Either we accept metaphor and its associated frameworks as integral to the theories of objectivity, in which case the theories refute themselves, or we reject these frameworks, leaving the theories broken and unable to defend themselves against opposing views.

CONCLUSION: UNDERSTANDING EPISTEMOLOGY AND SCIENCE THROUGH METAPHOR

I would now like to briefly point to some of the implications of these findings on studying objectivity and other epistemological concepts, as well as science. The first point is a methodological one. Metaphor, with its significant and distinctive role in expressing and defending conceptions of objectivity, as well as its close, mutually illuminating ties with historical context, ought to be given close attention when seeking to understand the history of objectivity. Indeed, such analyses can be extended to other concepts when engaging in historical meta-epistemology.

As has been shown, metaphor cannot be ignored, as it is partly constitutive of the theories under consideration, nor can it be "translated" into purely literal terms, and it certainly cannot be dismissed as mere ornamentation. Indeed, some suggest that an acknowledgement of metaphor's role in concept-formation could have far-reaching consequences for the methods of analytic philosophy in general.[44]

Attention to metaphor will help to better understand science. That two of the most important proponents of scientific objectivity, Bacon and Popper, should face a dilemma that undermines their views is significant. It suggests that their conceptions of objectivity, and the conceptions descended from them, face some real difficulties. I believe that the foregoing analysis provides further evidence to move us away from such views, and towards those that recognize that metaphor is pervasive in science and necessary for its development. Metaphor is instrumental in the formation of scientific concepts, as "almost everywhere one looks in science there are things being treated as something else."[45] Metaphor and analogy also play an important role in scientific education. Finally, I believe that the findings of this analysis lend support to Kuhn's conception of the development of science through paradigms, and that a greater awareness of metaphor in science will deepen our understanding of the nature and function of these metaphor-like frameworks.

Notes

1. Hacking, pg. 55
2. Ortony, pg. 2
3. Lakoff and Johnson, pg. 5
4. Although I will be employing the terms "science," "objectivity," and "scientific objectivity" in discussing Bacon's views, he himself did not

employ these words in formulating his theory, as they had entirely different meanings in the seventeenth century.
5. Bacon, pg. 143.
6. Ibid., pg. 79.
7. Daston and Gallison, pg. 82.
8. Bacon, pg. 96.
9. Ibid., pg. 141.
10. Ibid., pg. 73.
11. Ibid., pg. 73.
12. This conception resembles Daston and Gallison's account of mechanical objectivity. The desire to let nature speak for itself, as well as the distrust of the particular aptitudes of the knower ("strength and excellency of wit") are emphasized in both conceptions. Interestingly, the imagery of mirrors and the convergence of light rays, metaphorical in Bacon, literally apply to the camera.
13. Bacon, pg. 90.
14. Ibid., pg. 146.
15. Ibid., pg. 146.
16. Ibid., pg. 73.
17. Ibid., pg. 113.
18. *Matthew* 7:15-17.
19. Bacon, pg. 81.
20. *Genesis* 3:19.
21. Bacon, pg. 85.
22. Popper, pg. 65.
23. Bloor, 1974, pg. 66.
24. Popper, pg. 63.
25. Ibid., pg. 64.
26. Ibid., pg. 64.
27. Ibid., pg. 64.
28. Bloor, 1974, pg. 68.
29. Ibid., pg. 68.
30. Ibid., pg. 68.
31. Popper, pg. 64.
32. Bloor, 1974, pg. 68.
33. Popper, pg. 68.
34. Ibid., pg. 67.
35. By contrast, Frege, with whom Popper associates his own theory, does provide such a defence. Frege rigorously explains and defends his theory of an objective "third realm" in logical and philosophical terms.

36. Popper, pg. 56.
37. Ibid., pg. 56.
38. In fact, this misconstrues Kuhn's analogy. According to Kuhn, proponents of different paradigms are like the speakers of different languages. He acknowledges that they are mutually translatable (within limits), and he does not deny that "there are many Hopis or Chinese who have learnt to master English very well" (Popper: 56). Indeed, it is precisely this process of learning to speak a new language like a native that is analogous to changing paradigms. The incommensurability thesis (which, I believe, is Popper's real target here) does not assert the impossibility of translation, but rather points to the fact that a person cannot speak in more than one language *at the same time*. See Kuhn, *The Essential Tension*, 1997.
39. Popper, pg. 57.
40. I wish to emphasize that I do not consider these contradictions to be total or of a purely logical nature (hence, the term 'dilemma' should not be taken in the strictly formal sense that it has in logic); rather, I assert that the metaphors are problematic *to the extent that*, or *insofar as* their nature and function conflict with the theories of which they are a part.
41. Popper, pg. 60.
42. Bacon, pg. 81.
43. Ricoeur, pg. 50.
44. See Bloor's "Dialectics of Metaphor," 1971, and Lakoff and Johnson's *Metaphors We Live By*, 2003.
45. Bloor, 1971, pg. 431.

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